Reports of the Meetings, pp. 61 &c., and has printed in this volume some very interesting notes :—on a remarkable colony of Alien Plants on an old heap of colliery (?) rubbish at Kingswood (J. W. White); on the Fungi of the Bristol district, part 6 (C. Bucknall); on Ridgway's Catalogue of North-American Birds (H. J. Charbonnier), treating forcibly of the necessity of restraining and limiting the making of genera and species out of closely allied forms, and advocating the *trinomial* system; on the porosity and density of rocks with regard to Water-supply (E. Wethered); on the Iron-turnings Cells and the supposed influence of Points in the liberation of Bubbles (A. M. Worthington); on an apparatus for observing Splashes (A. M. Worthington); the first Telephone (S. P. Thompson); the Rainfall at Clifton (G. F. Burder); and Meteorological Observations, as regards Temperature, at Clifton (H. B. Jupp). Part iii. of the Flora [living] of the Bristol Coal-field, edited by J. W. White, and enumerating the Corallifloræ, forms part of this volume.

Journal of the Royal Geological Society of Ireland. Vol. xvi. part ii.; n. s. vol. vi. part ii. for 1881–82. 8vo. 1882.
Transactions of the Geological Society of Glasgow. Vol. vii. part i. for 1880–82. 8vo. 1883.

In his Presidential Address, February 20, 1882, the Rev. Dr. Haughton, F.R.S. &c., sketching the progress of the Royal Geological Society of Ireland, pointed out (1) that the popularity of the "original Dublin Geological Society" was due to an unfounded hope that geologists would find coals and minerals sufficient to enable Ireland to compete with the rest of the British Isles in industrial pursuits and in consequent wealth; (2) that the preponderance of physical and stratigraphical over palæontological papers in the 'Transactions' is due to the comparative absence of Secondary and Tertiary strata in Ireland. Dr. Haughton next proceeded to the discussion of the "two speculative problems which await their solution and must occupy a foremost place in the geological discussions of the next fifty years:—I. The absolute duration of Geological Time. II. The physical causes of the Changes of Climate which have, beyond question, taken place in the higher latitudes of the Earth's Surface."

The first of these problems was treated by the Rev. Maxwell H. Close in his Presidential Address in 1878; and arguments in favour of the great duration of geological time have been based on :—1. The time requisite for the cooling down of the Sun. 2. The present figure of the Earth as compared with its present rate of rotation. 3. The estimate of Geological Time derived from the rate of increase of terrestrial temperature with depth. Dr. Haughton intimates that he has some further evidence in support of the last view. He further draws attention to the important department of research which he terms "Empirical Cosmogony," as elucidated by Mr.

George Darwin's papers on "Tidal Evolution," and by calculations by himself, Prof. Robert Ball, and Mr. A. R. Wallace, on the probable time taken in the deposition of the stratified rocks. Taking these at a thickness of 177,200 feet, 3,000,000 square miles as the area of deposition (on coast-lines for about 30 miles to sea), the land-surface exposed to denudation as 57,000,000 square miles (nineteen times the area of deposition), and the present rate of denudation as 1 foot in 3000 years, the duration of Geological Time equals about 28,000,000 years. It is to be remembered that it is highly probable, Dr. Haughton thinks, that during all geological time down to the close of the Tertiary period, the temperature of the Earth's atmosphere was higher than at present, and the more so the further back we go—the necessary consequences being greater evaporation, greater rainfall, greater denudation, greater trade- and antitrade-winds, greater ocean-currents, and greater facilities for spreading and depositing submarine strata.

It is now thought by Prof. Robert Ball that the great tides caused by the lesser distance of the Moon from the Earth (within some 50,000,000 years) were pregeological. Mr. J. S. Newberry thinks that the Eozoic rocks in North America do not show evidence of tides much greater than those now in action on the Atlantic shores of that region (including, however, the 70-ft. tide of the Bay of Fundy).

Dr. Haughton then took up the "Supposed Causes of Changes in Geological Climates."

I. *The Supposed former effects of Star-heat*, or warm portions of space, suggested by Poisson.

II. *The Obliquity of Ecliptic.* "As this speculation postulates the change of position of the Earth's axis in space, it must be set aside as irrelevant."

III. *Changes in Position of Pole*, that is of the Earth's axis within the Earth itself, causing the poles and equator to shift their positions. Such a change of position of the axis of rotation inside the Earth could be produced by changes of land and water, but not to nearly so great an amount as required to account for the former existence of tropical and subtropical animals and plants at places now in frigid climates, but yielding fossils representing such faunas and floras. Mr. G. Darwin, basing his calculations on the area of the "Pacific depression," finds the maximum change of latitude would be 3°, or 210 miles; and Dr. Haughton, taking Europasia (as elevated since the commencement of Tertiary times) for his basis, finds the change of latitude caused by that elevation to be only 1°, or 70 miles.

On the contrary, there is evidence of change of latitude to the extent of 50°, or 3640 miles, with Silurian corals; 43°, or 3010 miles, with Liassic fossils; 36°, or 2520 miles, with the fossil plants of Grinnel Land; 30°, or 2100 miles, with the fossil plants of Disco.

IV. *Eccentricity and Perihelion-Longitude of the Earth's Orbit*, producing a secular variation in climate. This was proposed by Adhemar, and worked out more fully by J. Croll, J. J. Murphy, and

A. R. Wallace. The change depending on the position of the perihelion is completed in about 21,000 years; while that depending on the eccentricity takes much more time for its course. The eccentricity may have been $\frac{1}{12}$ instead of $\frac{1}{60}$, as at present; but astronomers are unable to say when the maximum eccentricity took place. An alternate glaciation of the northern and southern hemispheres every 21,000 years has been hence deduced by Adhemar, Croll, and Murphy, the glaciation being more or less severe as the eccentricity in the perihelion period was greater or less. Croll places the glaciation of a hemisphere when its winter solstice was in aphelion, and Murphy places the glaciation of a hemisphere when its winter solstice was in perihelion.

Dr. Haughton thus expresses this secular inequality in climate:—

"The mean annual temperature of any place varies as the eccentricity of the earth's orbit and as the range of temperature from summer to winter jointly." He remarks, "Of these two factors of climate, viz. eccentricity and range of temperature, the first is astronomical, and the second terrestrial, depending on distribution of land and water, on ocean-currents and prevailing winds;" and he adds, "if we suppose the terrestrial factor to be the same while the eccentricity attains its maximum, the greatest possible change in mean annual temperature for any place on the earth's surface turns out to be less than 5° F.; and, in order to produce a sensible effect upon climate, we must suppose that the annual range (terrestrial factor) must vary also by variation in the distribution of land and water." Taking several examples of the present annual range of temperature at places where Miocene plant-beds exist, and calculating what the annual range must have been for those fossils, and allowing for any fairly possible distribution of land and water, Dr. Haughton shows that "change of eccentricity of the earth's orbit is not sufficient to account for former geological climates."

V. *Geographical Distribution of Land and Water.* This is shown in the foregoing discussion to be inadequate as a cause for the past changes in geological climate; and Dr. Haughton indicates that Mr. Wallace strongly supports the view of the relative persistence of the continental and oceanic areas, and that the present differences of the northern and southern hemispheres have existed from the beginning and are due to an eccentric position of the earth's centre of gravity. The southern hemisphere has thus been always more under water than the northern, and always will be. It is warmer than the northern, because it receives three tepid currents of equatorial water instead of one; and continental climates are and always have been characteristic of the northern, and insular climates of the southern hemisphere.

VI. *Alterations in Sun-heat.* This is accepted by Dr. Haughton as the most probable of all causes of change in geological climate, whether cold or hot. He thinks "that the Glacial period or periods were non-periodic, that they affected both hemispheres simultaneously, and depended altogether on physical changes in the sun itself, and not on the physical or astronomical conditions of the

earth." Mathematical formulæ, concerned with the foregoing discussions, are appended to the Address.

In the same volume Dr. E. Hull gives a clear statement of his views as to the occurrence of Laurentian beds in Donegal and elsewhere in Ireland, and a paper on the metamorphic rocks and minerals of Sligo and Leitrim, with analyses by Mr. E. T. Hardman. Mr. G. A. Kinahan supplies very interesting papers on the gold of Ireland and the geological structure of Bray Head. Mr. G. H. Kinahan explains why some palæozoic rocks in Galway and elsewhere cannot be regarded as Laurentian; and supplies a short but valuable illustrated note on some moraines on Mount Leinster, in counties Wicklow and Carlow. Prof. V. Ball gives a catalogue of the meteorites, of which there are specimens in the museums of Dublin, and includes the published analyses of four meteorites known to have fallen in Ireland.

The geologists of Glasgow, like those of Ireland, have brought down their published work to 1882; but, beginning with 1880, they make a thicker volume for this issue. It is richer in palæontological researches than the Irish Journal, on account of the great opportunities for collecting fossils, both from the varied Carboniferous deposits of Lanarkshire and neighbourhood and from the Post-tertiary beds of the Clyde valley. Of these last, as exposed in the dock of Garvel Park, at Greenock, Mr. D. Robertson gives a full account, with long lists of the fossils obtained. Graptolites and other fossils from Dumfriesshire are treated of by Mr. J. Dairon. The palæontology of Lesmahagow, Silurian and Carboniferous, is studied by Dr. J. R. S. Hunter, and some fossiliferous beds in the Beith and Daldry district by Mr. Robert Craig. Some fish-remains from East Kilbride are noted by Mr. James Coutts; Mr. John Young discriminates some Carboniferous *Fenestellæ*; and Mr. W. E. Koch gives an interesting note on Mull and its leaf-beds.

There are several good memoirs also on local geology (Muirkirk, Isle of Man, Renfrewshire, Shetland, &c.), and on boulders, limestones, and igneous rocks; also on the bismuth and tin deposits of Australia. Several of these papers are illustrated with plates.

Neither last nor least in this new volume of the 'Transactions' is an excellent account of the "Origin and Early History of the Geological Society of Glasgow" by Mr. T. M. Barr, who writes carefully and enthusiastically, and has much real pleasure in showing that good work has been done by the members, and that the society may fairly claim to have made its mark on the progress of geological science.

MISCELLANEOUS.

A proposed new 'Nomenclator Palæontologicus.'

We have received a printed report on the subject of a new 'Nomenclator Palæontologicus,' prepared by Dr. M. Neumayr, of